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**OPERATING
PROCEDURES AND
LABOR UTILIZATION IN
COTTONSEED OIL MILLS
1961-62 SEASON**

MARKETING ECONOMICS DIVISION • ECONOMIC RESEARCH SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

CONTENTS

	Page
Summary and conclusions	iii
Introduction.....	1
Operating procedures and practices.....	1
Total crush and length of operating season.....	2
Regional crush and type of process.....	4
Age of cottonseed oil mills.....	4
Size of mills and extraction methods.....	6
Cottonseed storage capacity.....	7
Distance of cottonseed haul.....	7
Handling practices for cottonseed products.....	10
Comparative labor use patterns among mills.....	13
Screw-press mills.....	13
Hydraulic, prepress-solvent, and direct-solvent mills.....	20
General appraisal.....	23
Appendix.....	27

SUMMARY AND CONCLUSIONS

A survey of 118 cottonseed oil mills revealed wide variations in labor use per ton of seed crushed. These mills represented about two-thirds of all oil mills in the United States. Screw-press mills were predominant, and the amount of labor used by these mills varied from 0.72 to 5.35 man-hours per ton of cottonseed crushed. Other types of operations surveyed included hydraulic, prepress-solvent, and direct-solvent mills.

Mill-by-mill comparisons showed that the pattern of labor utilization was frequently quite different in mills with similar operating volumes. But more important, impressive savings on labor costs were possible over an operating season even for some modest-sized mills. The average wage rate for mills participating in this survey was \$1.30 per hour. If a mill with a 21,000-ton seasonal crush would use 2 rather than 3 man-hours per ton--a feat accomplished by some mills--the annual saving could amount to over \$27,000.

The pattern of labor use revealed by the survey may help mill operators to determine whether they are making efficient use of labor. However, the information developed from this survey is not fully sufficient to guide management to courses of action that would answer all questions concerning optimum use of labor in the mills.

OPERATING PROCEDURES AND LABOR UTILIZATION IN COTTONSEED OIL MILLS, 1961-62 SEASON

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INTRODUCTION

Major changes in the pattern of the cottonseed processing industry that began emerging shortly after World War II have continued. The annual crush is being handled by fewer mills but by mills of larger volume. Hydraulic and slow-speed, screw-press operations continue giving way to the more efficient solvent and modern high-speed screw-press processes. Other important but less-apparent changes are associated with modernization of plant layouts and higher efficiencies in plant operations.

Labor is one of the most important items of cost in processing cottonseed. Since wage rates continue to move upward, this study was initiated to determine and evaluate the operating practices and labor-saving machinery in use at cottonseed oil mills.

The first phase of the study was to select mills for detailed study. Mills selected must use operating procedures and labor-saving machinery that offer the greatest potential savings. The features should be adaptable to other mills. This report gives a summary of data acquired through a mail survey. The planned second phase of the overall study will be an analysis of specific labor-saving machinery and operating practices.

OPERATING PROCEDURES AND PRACTICES

A questionnaire on size of plant, type of process, operating procedures, and labor utilization in cottonseed oil mills was sent to 253 mills. The questions related to the 1961-62 season. The questionnaire was sent to all the mills thought to be active that season. About 69 percent, or 174, of the plants returned the questionnaire. Out of these, 48 were marked "not in operation during the 1961-62 season." Only 118 of the questionnaires were filled in sufficiently for use in the study. If we assume that questionnaires were returned for all plants that were no longer in operation, there were 205 mills crushing cottonseed

1/ The study on which this report is based was made in cooperation with the Marketing Division, Cotton and Oilseed Branch, Farmer Cooperative Service. Elmer Perdue of that Service, helped in planning this study.

during the 1961-62 season. On this basis, the number of cottonseed oil mills supplying data was about 60 percent of the total number of operating mills. Similarly, they accounted for about two-thirds of the volume of cottonseed crushed by all operating mills in the United States during the 1961-62 season.

For purposes of this report, the regions are composed as follows:

Southwest--Arizona, California, Oklahoma, Texas, and New Mexico.

Valley--Arkansas, Missouri, Louisiana, Mississippi, and Tennessee.

Southeast--Alabama, Georgia, North Carolina, and South Carolina.

As to regional distribution of the mills reporting, those with the largest crush were in the Southwest; those with the smallest in the Southeast. This distribution closely approximates that of the total crush for the United States (table 1).

Table 1.--Distribution of volume of cottonseed crushed by all U.S. cottonseed oil mills and by 118 sample mills, by specified regions, 1961-62 season

Region	Crushed				
	All U.S. mills		Sample mills		Crush of sample mills as percent- age of total crush
	Quantity	Distribu-	Quantity	Distribu-	
	crushed	tion	crushed	tion	
	Tons	Percent	Tons	Percent	Percent
United States...	5,538,800	100.0	3,456,157	100.0	62.4
Southeast.....	620,500	11.3	358,483	10.3	57.8
Valley.....	1,579,400	28.6	888,643	25.8	56.3
Southwest.....	2,886,000	52.1	2,209,031	63.9	76.5
All others.....	452,900	8.0	--	--	--

Source: Bureau of the Census.

Total Crush and Length of Operating Season

Some mills crushed modest quantities of cottonseed per season; others crushed very large tonnages. Some operated for a few months a season; others operated nearly the year round. However, many of these differences were identified with the method of extraction. The length of season in general was shorter and the size of crush was smaller for the mills using mechanical processes, particularly the hydraulic (table 2). Also, in the Southeast and the Valley, operating seasons were shorter, and the size of crush smaller, than in the Southwest (table 3).

Table 2.--Average seasonal crush and distribution of total crush for specified lengths of operating season and by type of mill, 118 sample cottonseed oil mills, 1961-62 season

Length of crushing season (months)	Screw press		Hydraulic		Prepress solvent		Direct solvent	
	:		:		:		:	
	Average : Distribution:	Average : Distribution:	Average : Distribution:	Average : Distribution:	Average : Distribution:	Average : Distribution:	Average : Distribution:	Average : Distribution:
	seasonal: of total	seasonal: of total	seasonal: of total	seasonal: of total	seasonal: of total	seasonal: of total	seasonal: of total	seasonal: of total
	crush :	crush :	crush :	crush :	crush :	crush :	crush :	crush :
	↓	↓	↓	↓	↓	↓	↓	↓
	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent
3 and under...	7,606	2.2	3,840	2.1	--	--	--	--
4 to 6.....	14,900	20.0	8,546	42.0	35,185	19.8	16,950	7.6
7 to 9.....	31,468	49.6	13,771	52.6	49,358	34.8	38,602	17.3
10 to 12.....	45,453	28.2	6,000	3.3	107,496	45.4	334,510	75.1
Total.....	26,152	100.0	10,175	100.0	59,168	100.0	89,123	100.0

Table 3.--Average seasonal crush and distribution of total crush for operating seasons of specified lengths, 118 sample cottonseed oil mills in 3 regions, 1961-62 season

Length of crushing season (months)	Southeast		Valley		Southwest	
	Average :Distribution:		Average :Distribution:		Average :Distribution:	
	seasonal: of total		seasonal: of total		seasonal: of total	
	crush	crush	crush	crush	crush	crush
	<u>Tons</u>	<u>Percent</u>	<u>Tons</u>	<u>Percent</u>	<u>Tons</u>	<u>Percent</u>
3 and under...	4,082	3.5	6,443	1.5	12,171	1.1
4 to 6.....	11,300	44.9	16,028	29.5	19,546	11.5
7 to 9.....	13,272	41.4	35,618	53.2	36,948	38.5
10 to 12.....	18,050	10.2	45,667	15.8	83,137	48.9
Total.....	11,751	100.0	25,570	100.0	43,314	100.0

Regional Crush and Type of Process

Among the 118 mills furnishing data, the screw press was used in over half of them. The hydraulic method of extraction was second, the prepress-solvent third, and the direct-solvent fourth (table 4).

About half of the screw-press mills were located in the Southwest, with the remainder equally distributed between the Valley and the Southeast. Half of the replies from hydraulic mills came from the Valley, and about a third of them came from the Southwest. The prepress-solvent mills were almost evenly divided between the Valley and the Southwest, while the direct-solvent mills were mostly in the Valley. However, both of the latter methods of extraction were represented in all three processing areas (table 4).

Screw-press mills accounted for the greatest volume of cottonseed crushed. Prepress-solvent mills reported the next largest seasonal crush followed by direct-solvent mills and hydraulic mills (table 5).

Age of Cottonseed Oil Mills

The number of years that the cottonseed processing units have been in operation, as reported by the sample mills, showed considerable variation--much of which is associated with type of process.

The hydraulic method has been known to the industry longer than any of the other processes. The screw press, affording an improvement in mechanical extraction, was introduced next. The latest methods are the prepress-solvent, and the direct-solvent.

Table 5.--Distribution of the volume of cottonseed crushed by sample cottonseed oil mills, by region and type of mill, 1961-62 season

Region	Screw press		Hydraulic		Prepress solvent		Direct solvent	
	Quantity	Distri-	Quantity	Distri-	Quantity	Distri-	Quantity	Distri-
	crushed	bution	crushed	bution	crushed	bution	crushed	bution
	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent
Southeast...	267,682	12.8	62,247	32.9	10,154	1.4	18,400	4.0
Valley.....	506,250	24.2	88,982	47.1	181,444	25.6	111,967	24.0
Southwest...	1,318,242	63.0	37,862	20.0	518,417	73.0	334,510	72.0
All regions...	2,092,174	100.0	189,091	100.0	710,015	100.0	464,877	100.0

Some of the mills reported having used hydraulic equipment for as long as 70 years, while none of the screw-press extraction units had been in operation more than half that long (table 6). All solvent-process mills indicated an operating span of 20 or less years.

Table 6.--Distribution of mills by operating life of extraction equipment and type of mill, 116 sample cottonseed oil mills, 1961-62 season

Years in operation	Screw press	Hydraulic	Prepress solvent	Direct solvent	All mills
	Number	Number	Number	Number	Number
0 - 5.....	13	--	--	2	15
6 - 10.....	40	1	7	2	50
11 - 15.....	25	2	3	1	31
16 - 20.....	3	3	1	--	7
21 - 35.....	2	3	--	--	5
36 - 50.....	--	4	--	--	4
51 - 70.....	--	4	--	--	4

Note: Two mills did not report age.

Size of Mills and Extraction Methods

The screw-press method of extraction outnumbered other methods in all sizes of operations in the cottonseed processing industry. Some of the larger crushes in the industry are processed with high-speed screw presses. Much of the lead acquired by screw presses came about through the displacement of hydraulic extraction units following World War II. The prepress-solvent and direct-solvent

methods have entered the field to some extent but at a much slower rate than the high-speed screw press. Usually, the prepress-solvent and the direct-solvent methods are confined to extremely large operations.

Among the mills participating in this study, 37 crushed 100 tons or less of cottonseed per 24 hours, 61 crushed from 101 to 200 tons, and 20 mills crushed 201 tons or more. All mills crushing 100 tons or less per 24 hours used either screw-press or hydraulic methods of oil extraction. But the screw presses outnumbered the hydraulic presses almost 2 to 1.

All types of extraction methods were used in the 61 mills crushing from 101 to 200 tons of cottonseed per 24 hours. However, about 75 percent of the mills within this range used screw presses, 11 percent used hydraulic presses, and 7 percent each used prepress-solvent and direct-solvent methods.

Among the larger operations crushing 200 tons and over of cottonseed per 24 hours, 52 percent were screw-press, 38 percent were prepress-solvent, and 10 percent were direct-solvent mills. No mills using hydraulic presses were in this size group (table 7).

Cottonseed Storage Capacity

The average storage capacity of reporting mills by area and size of mill varied from 46 to 92 percent of the annual crush per mill during the 1961-62 season. The 32 mills in the Southeast area could store the equivalent of two-thirds of the quantity of cottonseed crushed during the season. However, the percentage storage capacity was three-fourths of the seasonal crush among the mills with 100 tons and under daily crushing capacities, but was only 59 percent of the seasonal crush among mills with capacities ranging from 101 to 200 tons.

The Valley mills reported storage capacities that averaged 70 percent of the volume crushed. The storage capacities as a percentage of seasonal crush decreased as the daily crush increased.

Storage capacities averaged a little more than one-half of the quantity crushed for Southwest mills. But, among these mills, storage capacity as a percent of annual crush was greatest for those crushing from 101 to 200 tons of seed daily, and smallest for those crushing 201 tons and over.

For the United States as a whole, reporting mills showed storage capacities that averaged 60 percent of the annual crush but that varied from 47 to 71 percent among the three size groups (table 8).

Distance of Cottonseed Haul

On an average, all reporting cottonseed oil mills obtained a little more than one-third of their supply of cottonseed from within a radius of 25 miles of the mill location. A little less than one-third of the seed crushed was hauled distances ranging from 26 to 50 miles, 16 percent was hauled from points 51 to 75 miles away, and 20 percent was hauled from locations 76 miles or more away.

Table 7.--Distribution of reporting cottonseed oil mills by size and type of mill, 1961-62 season

Size of mills-- tons crushed per 24 hours	Screw press			Hydraulic			Prepress solvent			Direct solvent			Total
	:			:			:			:			
	:			:			:			:			
	:			:			:			:			
	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	: : Distrib- : bution : by-- : Mills: : Type : of : mill	
	<u>No.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>No.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>No.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>No.</u>	<u>Pct.</u>	<u>Pct.</u>	
100 tons and under.	24	29	64	13	65	36	--	--	--	--	--	37	
101 - 200 tons.....	46	57	75	7	35	11	4	33	7	4	67	61	
201 tons and over..	10	14	50	--	--	--	8	67	40	2	33	20	
All mills.....	80	100	68	20	100	17	12	100	10	6	100	118	

Table 8.--Sample cottonseed oil mills: Cottonseed storage capacity related to volume of cottonseed crushed, by region and size of crush, 1961-62 season

Region and size of crush per 24 hours	Mills	Storage capacity		Cottonseed crushed		Storage capacity as a percentage of seasonal crush
		Total	Average	Total	Average	
	Number	Tons	Tons	Tons	Tons	Percent
Southeast.....	32	238,000	7,438	358,483	11,203	66.4
100 tons and under..	20	124,000	6,200	166,332	8,317	74.5
101 - 200 tons.....	12	114,000	9,500	192,151	16,013	59.3
201 tons and over....	--	--	--	--	--	--
Valley.....	35	618,000	17,657	888,643	25,390	69.5
100 tons and under..	7	54,000	7,714	58,634	8,377	92.1
101 - 200 tons.....	23	416,800	18,122	561,984	24,434	74.2
201 and over.....	5	147,200	29,440	268,025	53,605	54.9
Southwest.....	51	1,206,300	23,653	2,209,031	43,314	54.6
100 tons and under..	10	80,800	8,080	148,962	14,896	54.2
101 - 200 tons.....	26	518,000	19,923	727,767	27,991	71.2
201 and over.....	15	607,500	40,500	1,332,302	88,820	45.6
All mills.....	118	2,062,300	17,486	3,456,157	29,290	59.7
100 tons and under..	37	258,800	6,995	373,928	10,106	69.2
101 - 200 tons.....	61	1,048,800	17,194	1,481,902	24,294	70.8
201 tons and over....	20	754,700	37,735	1,600,327	80,017	47.2

On an individual mill basis, there was considerable variation in the quantity of seed hauled different distances from the mill. Density of seed production and mill requirements are two important factors that influence length of haul. As a usual rule, the larger the annual crush, the farther a mill will have to haul its seed.

Mills located in the Southeast and the Valley showed a closer similarity in seed procurement patterns in regard to distance than the mills located in the Southwest. In the Southeast and the Valley, more than two-thirds of the seed came from supply points 50 miles or less from the mill. However, the Southwest mills obtained a little less than two-thirds of their seed from within a radius of 50 miles of the mill's location, and 29 percent of their seed from points 75 miles distant or more (table 9). There was also considerable variation in practices among the different mill size groups. The smaller mills hauled the greater part of their seed a shorter distance than the larger mills. Although smaller mills bought a lesser proportion of their seed from distant points, mills in each size group went out 76 miles or more for some of their seed (table 9).

Table 9.--Sample cottonseed oil mills: Percentage of crush hauled specified distances, by region and size of mill, 1961-62 season

Region and size of mills	Mills	Cottonseed hauled a distance of--			
		Less than 25 miles	26 to 50 miles	51 to 75 miles	76 miles and over
	Number	Percent	Percent	Percent	Percent
Southeast.....	32	32.8	36.8	19.0	11.4
100 tons and under....	20	36.3	43.3	13.9	6.5
101 to 200 tons.....	12	26.9	26.1	27.5	19.5
Valley.....	35	33.2	31.6	20.5	14.7
100 tons and under....	7	30.1	44.6	18.1	7.2
101 to 200 tons.....	23	36.9	28.0	20.5	14.6
201 to 300 tons.....	5	20.4	30.4	23.8	25.4
Southwest.....	51	39.0	21.0	10.6	29.4
100 tons and under....	10	51.8	12.7	3.5	32.0
101 to 200 tons.....	26	40.3	21.8	10.9	27.0
201 to 300 tons.....	7	32.0	16.8	6.4	44.8
301 tons and over.....	8	24.3	32.5	22.2	21.0
All mills.....	118	35.6	28.4	15.8	20.2
100 tons and under....	37	39.3	35.3	11.9	13.5
101 to 200 tons.....	61	36.4	25.0	17.8	20.8
201 to 300 tons.....	12	27.2	22.5	13.6	36.7
301 tons and over.....	8	24.3	32.5	22.2	21.0

Handling Practices for Cottonseed Products

The products produced from cottonseed are oil, meal, hulls, and linters. The oil is used almost entirely for human consumption in various edible products; the meal and the hulls are used principally as livestock feed; and the linters are used for various industrial purposes. Cottonseed is crushed primarily for the purpose of producing the higher revenue yielding products, oil and meal.

Handling of extracted oil is highly automated at most mills. The crude oil is usually pumped from the extraction facilities into storage tanks, or directly into tank cars and trailers, for shipment to refineries or other market outlets.

For the mills as a whole, the amount of oil that could be stored at any one time was something over 111.5 million pounds and averaged about 9 percent of an estimated production of more than 1.2 billion pounds for the 1961-62 season. This meant that most mills could hold crude oil only a relatively short time before moving it to market. Oil was shipped as it was produced by some mills and none was held more than 90 days by any of the reporting mills (table 10).

Table 10.--Oil-storage capacity and number of days crude oil was held before marketing, 118 sample cottonseed oil mills, 1961-62 season

Number of days held	Mills reporting	Storage capacity of sample mills	
		Quantity	Average per mill
	Number	1,000 pounds	1,000 pounds
5 and under.....	35	20,138	575
6 to 10.....	32	26,056	814
11 to 15.....	15	13,455	897
16 and over.....	23	41,406	1,800
Holding time not reported.....	10	10,470	1,047
Total.....	115	111,524	970

Cottonseed oil cake, the residue after the oil is extracted, is processed and sold primarily as feed for livestock. It is marketed in several forms including bagged meal, bulk meal, bagged pellets, bulk pellets, sized cake, and mixed feed.

In the Southeast and the Valley areas, most of the cake was processed into cottonseed meal. The meal was then handled mainly in bags. However, a majority of the reporting mills disposed of some meal in bulk form. A few mills marketed small quantities in the form of bagged pellets, sized cake, and mixed feed (table 11).

Table 11.--Sample cottonseed oil mills: Distribution of processed sized cottonseed cake, sold in various forms, by region, 1961-62 season

Region	Mills	Average percentage of cake sold in the form of--					
		Bagged meal	Bulk meal	Bagged pellets	Bulk pellets	Sized cake	Mixed feed
	Number	Percent	Percent	Percent	Percent	Percent	Percent
Southeast.....	30	87.6	9.0	2.1	--	1.0	0.3
Valley.....	35	71.0	22.6	3.7	--	1.1	1.6
Southwest.....	50	40.8	26.2	25.2	0.6	3.8	3.4

Although more meal was bagged than handled otherwise in the Southwest, bulk distribution in this area was more popular than it was in the Southeast and the Valley. Moreover, a greater quantity of the cake was processed and

distributed as bagged pellets than in the other two areas (table 11). The greater popularity of pellet processing is probably due to more extensive range feeding of cattle in the Southwest than in the Valley and the Southeast.

Most of the reporting mills showed a preference for handling cottonseed hulls in bulk form. However, there was considerable variation in handling practices among areas and also among the individual mills within an area. Out of all mills, 41 marketed 100 percent of their hull production in bulk form. Nine mills disposed of all of their hulls in bags. The remainder of the mills handled hulls both in bags and in bulk (table 12). In the Southeast area, all of the reporting mills sold 65 percent or more of their hulls in bags and 9 bagged all of their hulls (table 12).

In both the Valley and the Southwest areas, bulk handling was strongly favored. Thirty-three of the reporting mills in the Southwest and 8 of the mills in the Valley marketed hulls in bulk form only. Most of the remaining mills in the two areas sold from 60 to 95 percent of their hull production in bulk (table 12).

Table 12.--Number and location of mills handling specified percentages of bulk and bagged hulls, 116 sample cottonseed oil mills, 1961-62 season

Percentage of hulls handled in bulk and in bags:		Se-	Valley	Southwest	All mills
		theast			
Bulk	Bagged	Mills	Mills	Mills	Mills
100	0.....	--	8	33	41
95	5.....	--	2	3	5
90	10.....	--	--	1	1
85	15.....	--	4	1	5
80	20.....	--	1	8	9
75	25.....	--	2	2	4
70	30.....	--	3	--	3
65	35.....	--	2	1	3
60	40.....	--	3	--	3
55	45.....	--	1	--	1
50	50.....	--	2	--	2
45	55.....	--	--	--	--
40	60.....	--	1	--	1
35	65.....	1	1	--	2
30	70.....	2	2	--	4
25	75.....	1	1	1	3
20	80.....	2	1	--	3
15	85.....	--	1	--	1
10	90.....	6	--	--	6
5	95.....	10	--	--	10
0	100.....	9	--	--	9
Total mills.....		31	35	50	116

Note: Two mills did not report this information.

COMPARATIVE LABOR USE PATTERNS AMONG MILLS

The primary purpose of the survey was to furnish descriptions of existing labor-use patterns for cottonseed oil mills. With the help of these data, appropriate mill situations can be selected and used in a detailed follow-up study of important causes of differences in labor efficiency.

The part of the questionnaire concerned with the organization of the labor force within a mill is shown in the Appendix. Because each participating mill also reported the quantity of cottonseed crushed per 24 hours, the amounts of labor designated for the various operations could be converted readily into hours of labor per ton of seed crushed.

In summarizing labor requirements per ton of seed crushed, labor used to unload seed was excluded because of the highly seasonal nature of this operation. Labor requirements for each of the other phases were dealt with individually and, for the purpose of further comparison, were also combined into the following subgroups:

Pre-extraction labor.--includes labor required for removing seed from storage, for cleaning seed in the lint room, in the bale press room, and for hull separation.

Pressroom labor.--manual and technical labor; checking details of operation.

Post extraction labor.--includes labor used in the meal room, for hull storage and loading, and for "other" miscellaneous purposes.

Finally, to allow for distinctions in extraction techniques, comparisons of patterns of labor use among mills were made separately for screw-press hydraulic, prepress-solvent, and solvent-type operations. For all comparisons, mills were arrayed successively according to the total hours of labor required per ton of seed crushed beginning with the mill having the largest and ending with the mill having the smallest labor requirement.

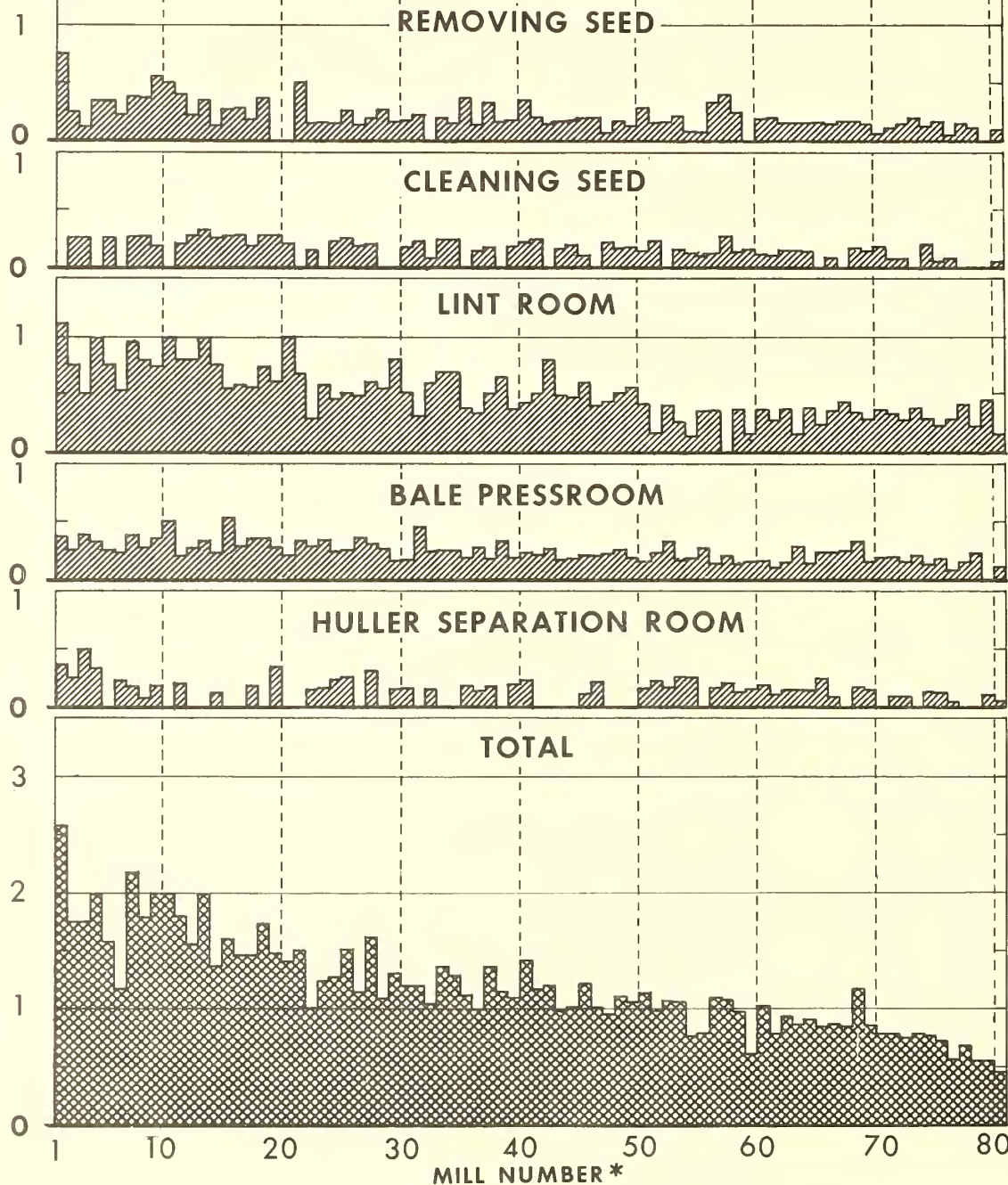
Screw-Press Mills

The patterns of labor requirements per ton of cottonseed crushed for operations involving the use of pre-extraction labor are shown in figure 1. Gaps occur, i.e., no labor requirements for certain activities are indicated in some instances, because certain mills chose to lump these labor requirements together under some other activity. Pressroom labor and the combination of pressroom labor and total pre-extraction labor are shown in figure 2. Labor requirements for post-extraction activities separately and in total are illustrated in figure 3. Finally, figure 4-B summarizes total pre-extraction, pressroom and total post-extraction labor requirements for each of the participating screw-press mills.

Several identifying features of mill operating procedures, viz., the use of holding bins, delinting capacity in relation to pressroom capacity, the number of shifts, and the number of presses, were recorded in figure 4-A to

PRE-EXTRACTION LABOR USED

MAN-HOURS PER TON OF SEED CRUSHED



DATA ARE FOR 1961-62 SEASON.

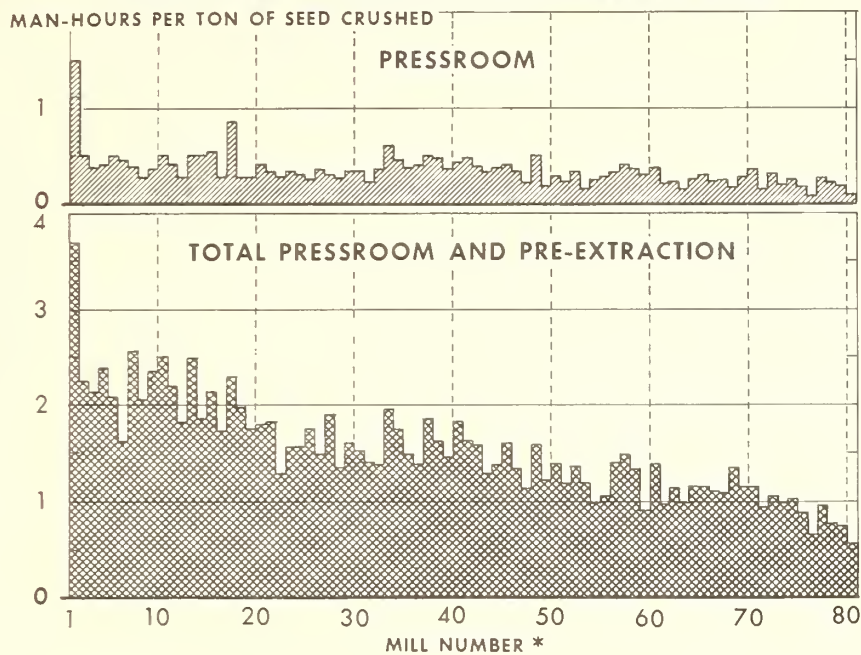
* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

Figure 1

80 Surveyed U. S. Screw-Press Cottonseed Oil Mills

PRESSROOM AND PRE-EXTRACTION LABOR USED

MAN-HOURS PER TON OF SEED CRUSHED



DATA ARE FOR 1961-62 SEASON.

* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

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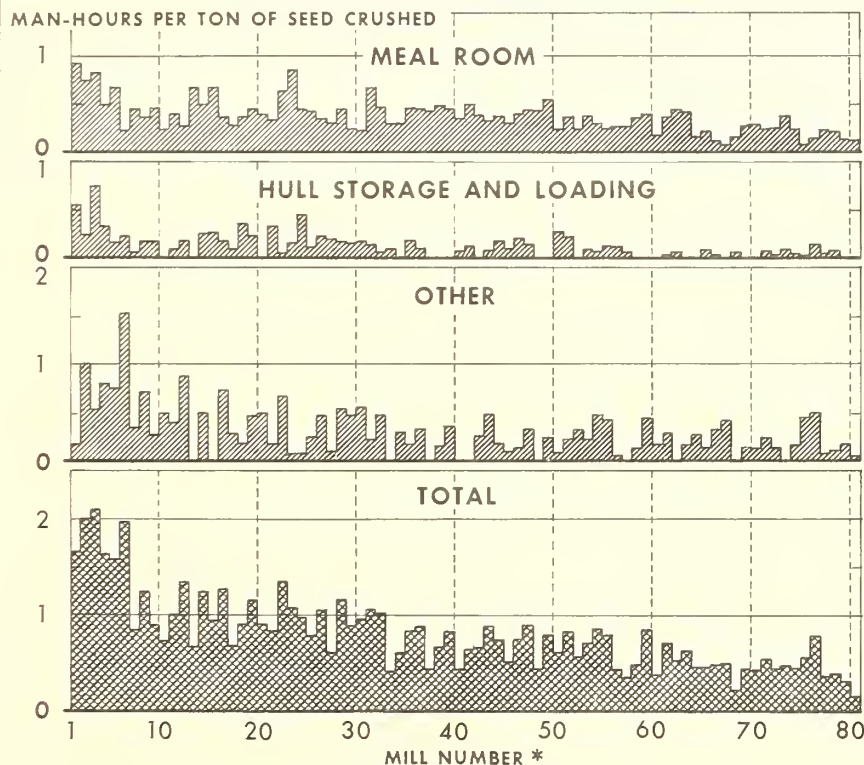
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Figure 2

80 Surveyed U. S. Screw-Press Cottonseed Oil Mills

POST-EXTRACTION LABOR USED

MAN-HOURS PER TON OF SEED CRUSHED



DATA ARE FOR 1961-62 SEASON.

* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

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Figure 3

SPECIFIED OPERATING FEATURES

GROUP A

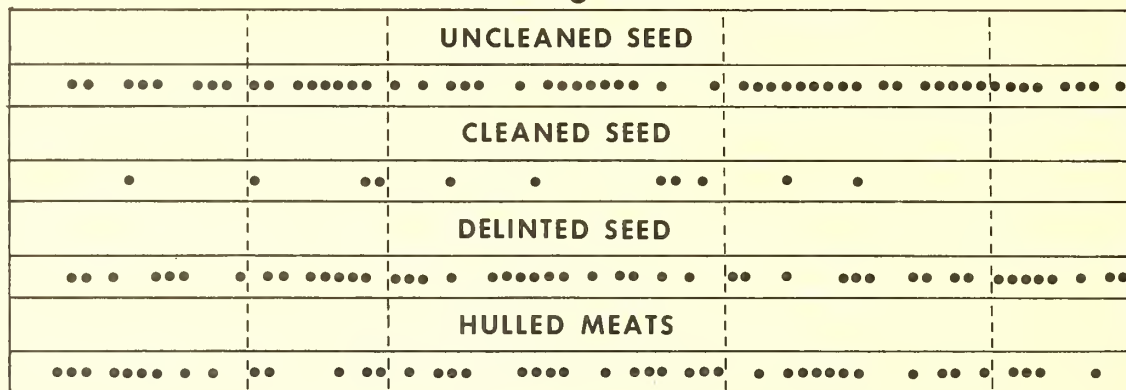
GROUP B

GROUP C

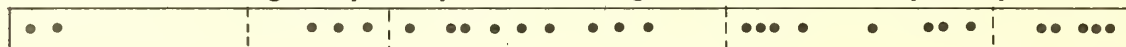
GROUP D

GROUP E

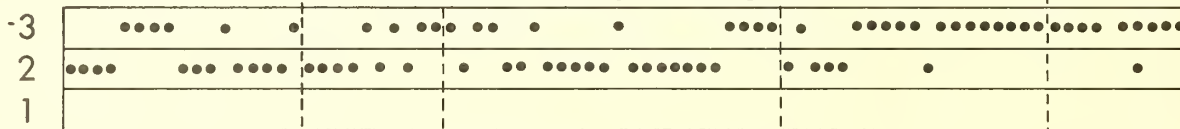
Holding Bins



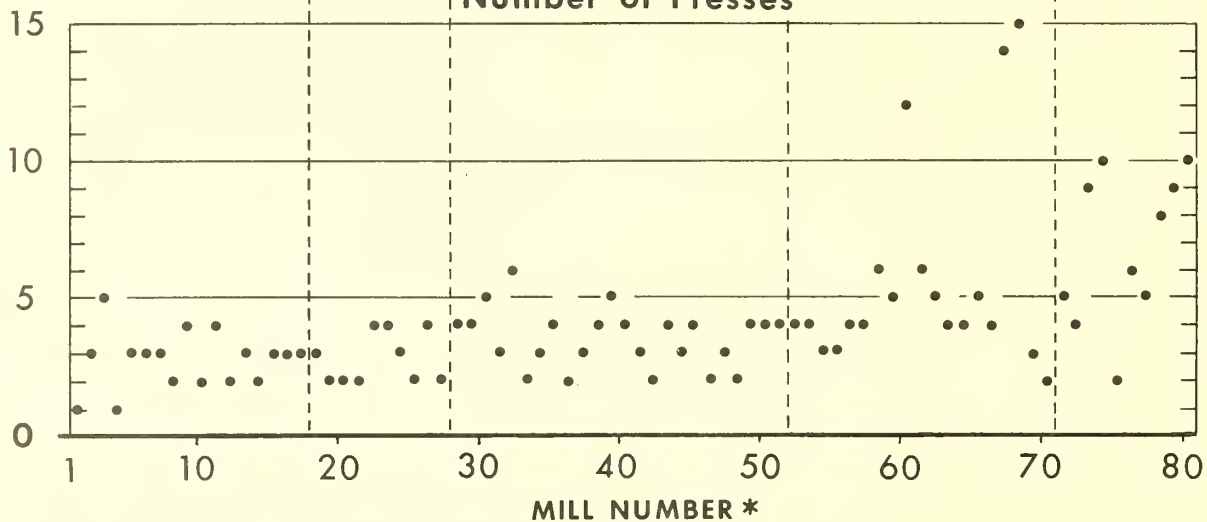
Delinting Capacity Exceeding Pressroom Capacity



Number of Operating Shifts



Number of Presses



DATA ARE FOR 1961-62 SEASON.

* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

SEE FIGURE 4 FOR EQUIPMENT AND CRUSH OF DIFFERENT GROUPS.

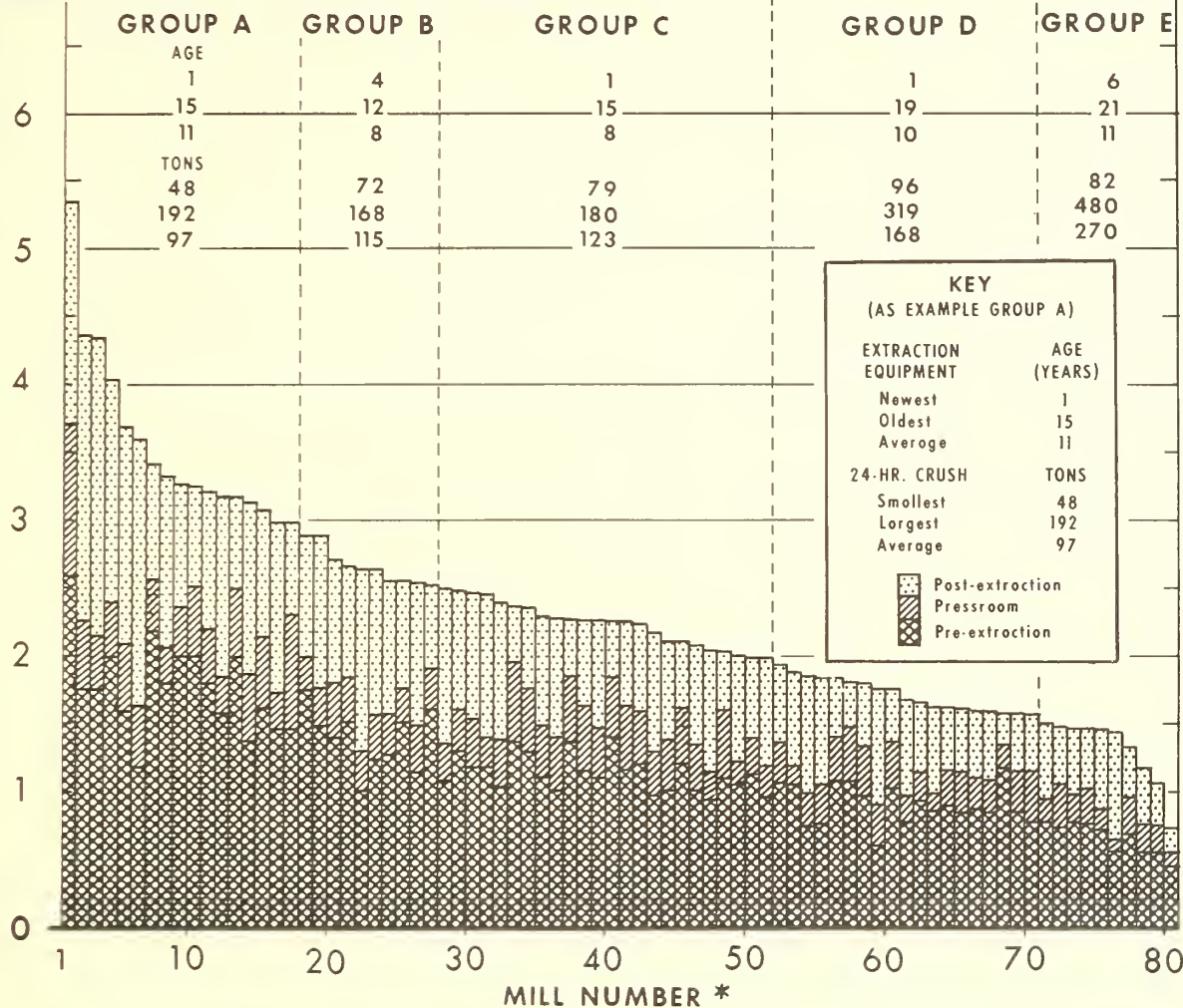
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Figure 4-A

TOTAL LABOR USED

MAN-HOURS PER TON OF SEED CRUSHED



DATA ARE FOR 1961-62 SEASON.
 * ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

Figure 4-B

examine their possible relationship to labor use. The three highest labor-using mills, requiring more than 4 man-hours per ton of seed crushed, had no holding bins of any sort. The next, using 4 man-hours per ton, had a holding bin for hulled meats only. However, all of the remaining mills used two or more types of holding bins in their operations, but the combinations of bins used were distributed among mills in such a fashion that the effect on labor use was not readily apparent. Even when the sizes of the holding bins were compared to the respective crushing capacities of the mills, little was learned of the contribution of these devices to labor efficiency (fig. 5). Holding bins that were large in relation to crushing capacity, particularly for uncleaned and delinted seed, were used by some mills having remarkably different labor requirements. To explain how holding bins are used more advantageously by some mills than others would require comparative analyses of differing operational circumstances using information much beyond that obtained in the survey.

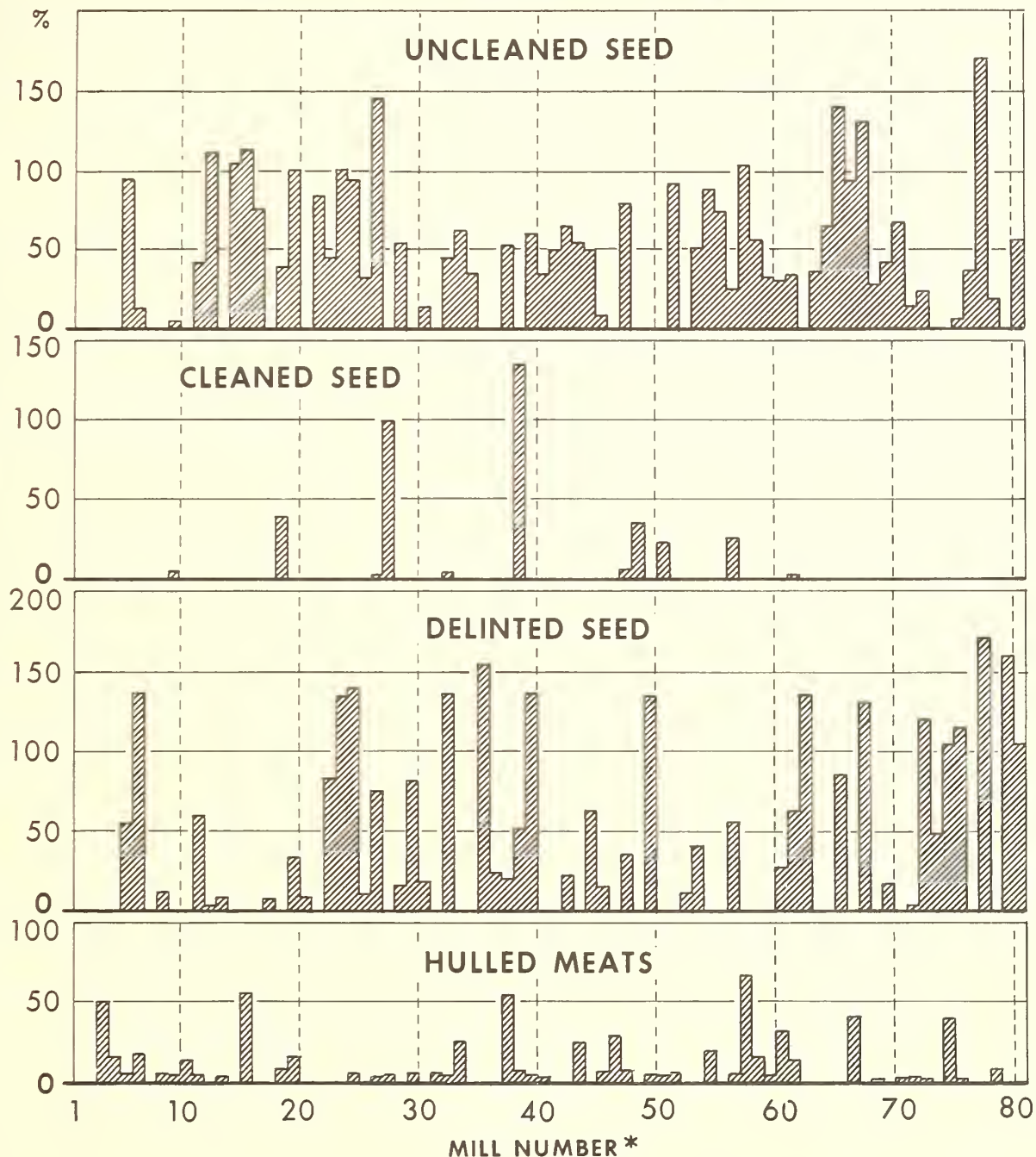
Theoretically, mills with extra delinting capacity, particularly if holding bins for delinted seed were available, could operate the lint room less than 24 hours per day and thereby lower labor requirements. However, the distribution of mills with delinting capacity in excess of pressroom capacity appearing in figures 4-A and 4-B does not indicate that these mills enjoy any particular advantage over others. If labor economies are realized from extra lint room capacity, presumably they are offset by other unidentified inefficient operating practices not followed by mills without the extra lint room capacity but with lower or similar labor requirements.

A few more mills used the 3-shift than the 2-shift operating schedule per 24 hours and the majority of mills using less than 2 man-hours per ton of seed crushed were 3-shift operations (figs. 4-A and 4-B). Perhaps, because of greater flexibility, 3-shift operations offer somewhat better opportunities for reducing labor requirements.

While not a perfect indication of the size of the operations in terms of seed crushed because of differences in press capacities, the number of presses per mill help to further describe the different mill situations. Evidently, some mills operating only a few presses, as well as those operating the larger number of units, are capable of holding down labor needs to 2 man-hours or less per ton.

Mills were classified into Groups A, B, C, D, and E in figure 4-B to allow an examination of the relationship between volume crushed and man-hours per ton without disclosing the volume for any particular mill. On the extremes, group A mills used 3 man-hours or more per ton and group E mills 1.5 man-hours or less. Groups B, C, and D were segregated by 1/2 man-hour per ton intervals. The largest, average, and smallest tons crushed per 24 hours are shown for each group of mills. The most, fewest, and average number of years of operating service for extraction equipment (presses) are also shown for mills in each group. For some reason, unexplainable without further study, the average years of operating service for extraction equipment tended to increase slightly from group to group of mills having successively lower labor requirements per ton of seed crushed.

CAPACITY OF HOLDING BINS AS PERCENTAGE OF 24-HOUR CRUSH



DATA ARE FOR 1961 - 62 SEASON.

* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

Figure 5

The ranges in volumes crushed suggest some interesting implications. The tendency for the largest crushes for each group to increase successively in size following Group A indicates that larger volumes are conducive to reductions in labor requirements per ton. However, relatively small crushes can be noted also for each group of mills, which means that inability to increase the size of the operation need not be an insurmountable barrier to increased labor efficiency. The most practical approach to improved labor efficiency for the less-efficient mills might be to emulate the labor force organizations and practices of their more successful counterparts with similar operating capacities rather than looking to increased volume as the only solution.

Hydraulic, Prepress-Solvent, and Direct-Solvent Mills

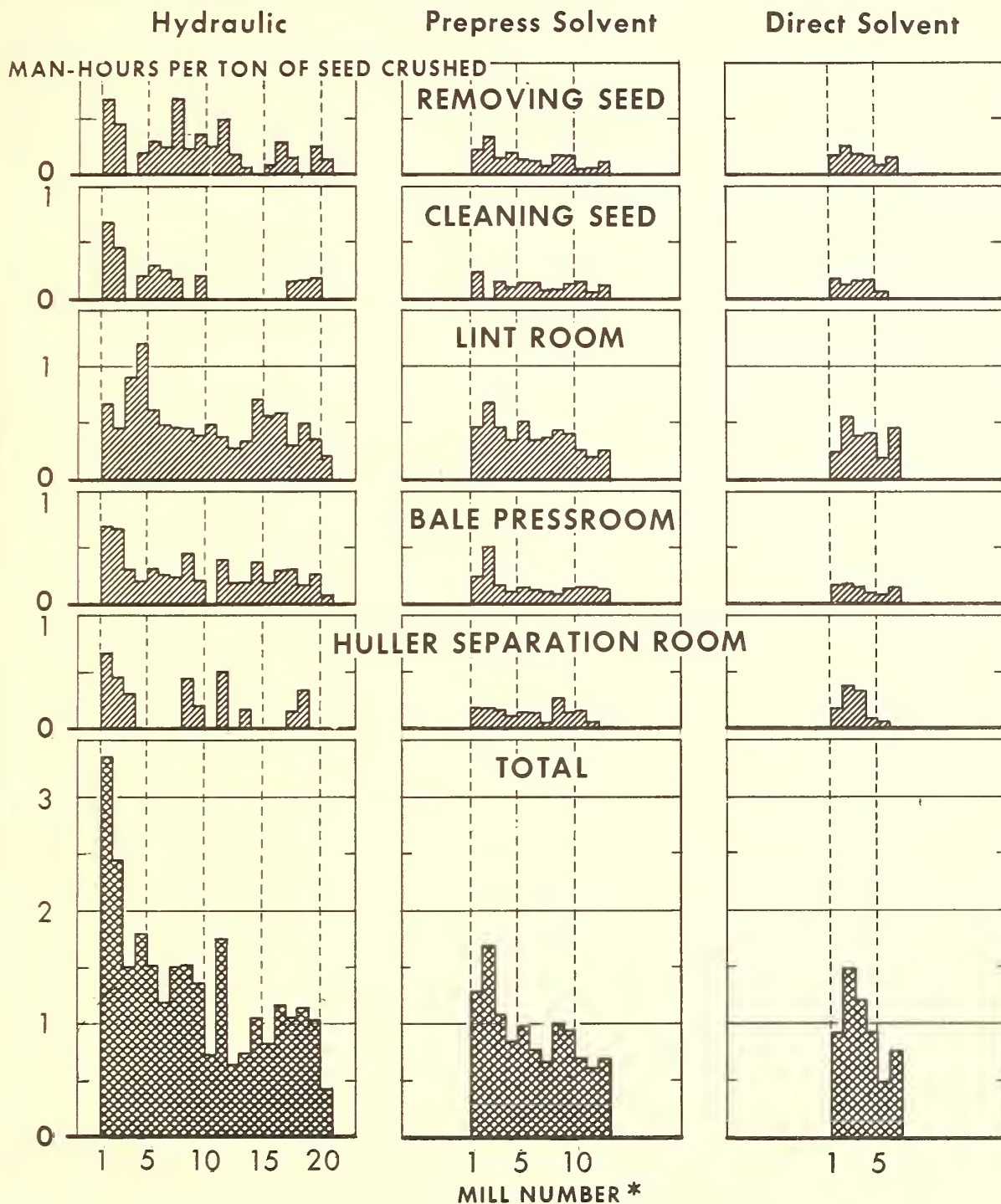
Because of the small number of mills in each category, appropriate labor-use patterns are presented simultaneously in figures 6 through 9-B for mills using the above extraction processes. Labor requirements per ton of seed, particularly pressroom labor, seem to be substantially lower, usually for mills using either of the solvent-extraction processes, than for hydraulic mills. Reference again to figure 4 shows that screw-press mills practically spanned the extremes of labor requirements for all processes, with some using nearly as much labor per ton as the higher labor-using hydraulic operations and others achieving labor requirements as low or lower than the solvent mills.

As with screw-press operations, information on the capacity and use of holding bins by hydraulic and solvent mills (fig. 10) did not shed much light on causes of differences in labor requirements. More information on the use of these devices, though, undoubtedly would reveal some relationship.

Three shifts per 24 hours apparently are better suited to the large solvent operations. All prepress mills with labor requirements lower than 2 hours per ton and all direct-solvent mills participating in the survey operated on a 3-shift schedule. The operating schedules of hydraulic mills present a puzzling situation that cannot be rationalized from information obtained in the survey.

Ranges in the sizes of crushes and the associated labor requirements for delineated groups of mills in figure 9-B indicate that, for each extraction process, important organizational features other than size of crush enter into the determination of differences in labor requirements.

PRE-EXTRACTION LABOR USED, BY SPECIFIED PROCESSES



DATA ARE FOR 1961-62 SEASON.

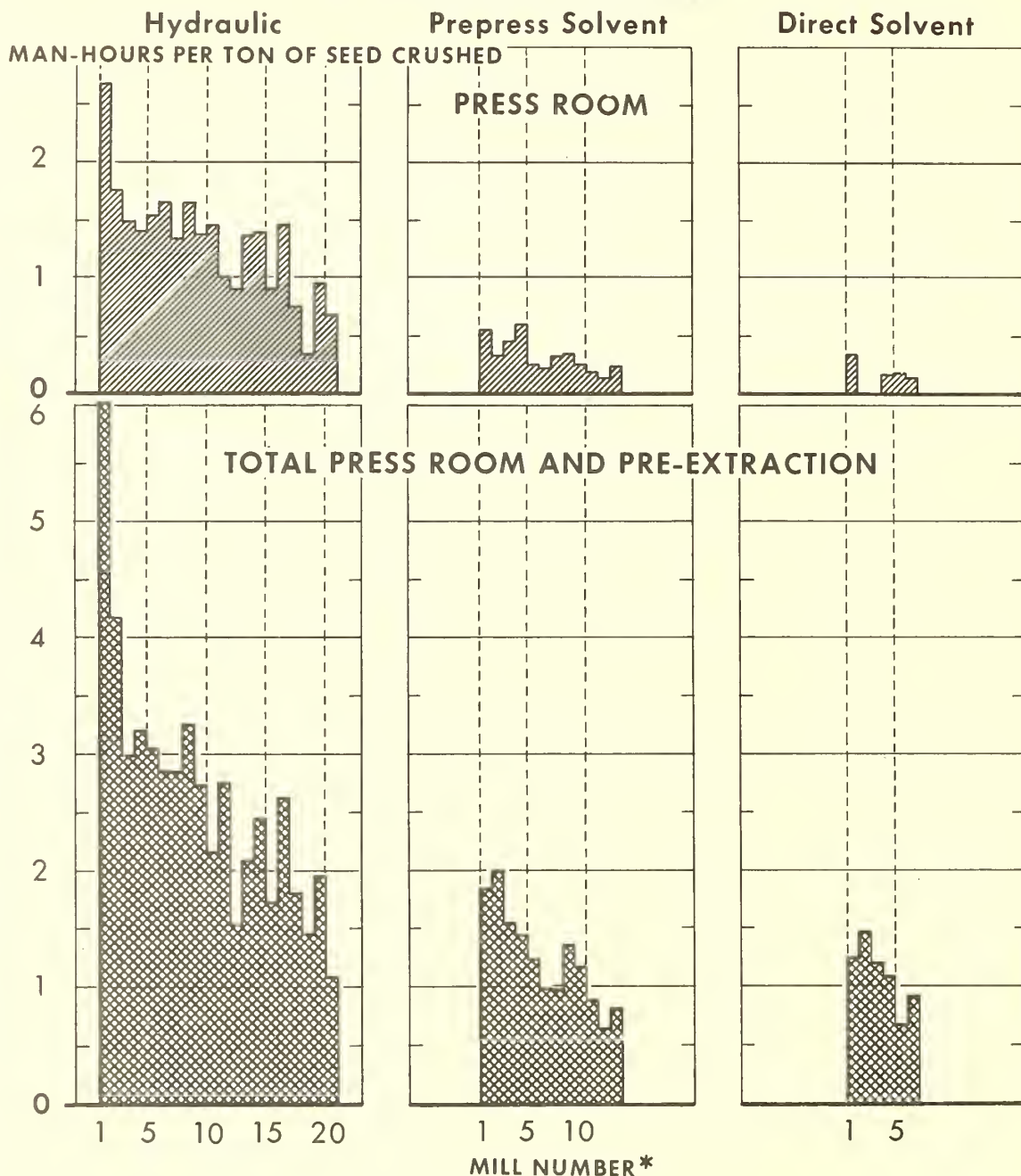
* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

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Figure 6

PRESSROOM AND PRE-EXTRACTION LABOR USED, BY SPECIFIED PROCESSES

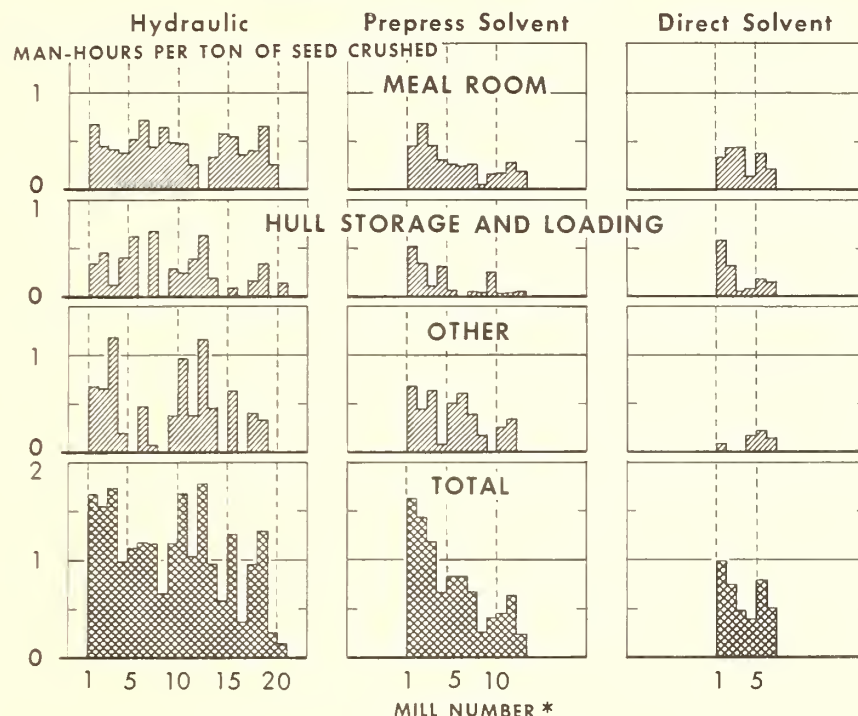


DATA ARE FOR 1961-62 SEASON.

* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

Figure 7

POST-EXTRACTION LABOR USED, BY SPECIFIED PROCESSES



DATA ARE FOR 1961-62 SEASON.

* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

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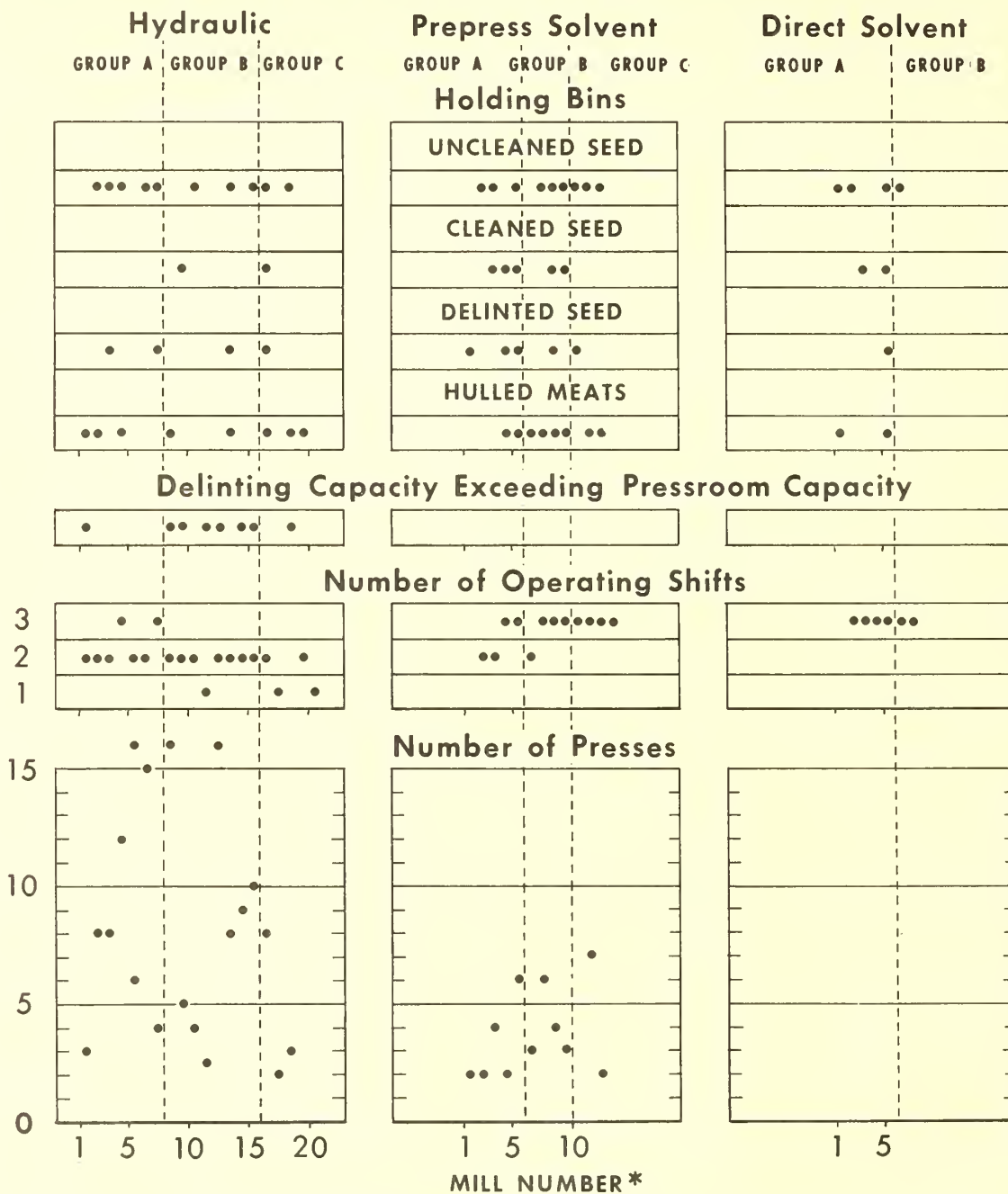
Figure 8
General Appraisal

Judging from the wide variation in labor efficiency among mills, a number of operators may find it well worthwhile to consider ways of modifying the organization of their labor forces. Particularly for those using more than 2.5 man-hours of labor per ton of seed crushed, economizing on the use of labor may be the most productive way to significant reductions in operating costs. Unlike power requirements and some other items contributing to operating costs, the make-up of the operating crew is, within limits, subject to the control of mill management.

Over an operating season, the accumulated savings could be impressive—even for modest-sized mills. The average wage rate for mills participating in the survey was \$1.30 per hour. For a mill with a 21,000-ton seasonal crush paying this wage rate, the use of only 2 rather than 3 man-hours of labor per ton of seed would mean a \$27,300 reduction in outlay for labor. Viewed another way, any annual outlays less than this amount could be profitably applied to financing changes in facilities and operating procedures that would reduce labor requirements.

The pattern of labor use revealed by this survey can show mill operators if their labor requirements are seriously out of line. Alone, however, the information is insufficient to point to courses of action that may solve the problems of individual mills. On-the-scene case studies of comparative plant layouts and other mill features are needed to establish practical guidelines for the identification, measurement, and correction of labor inefficiencies.

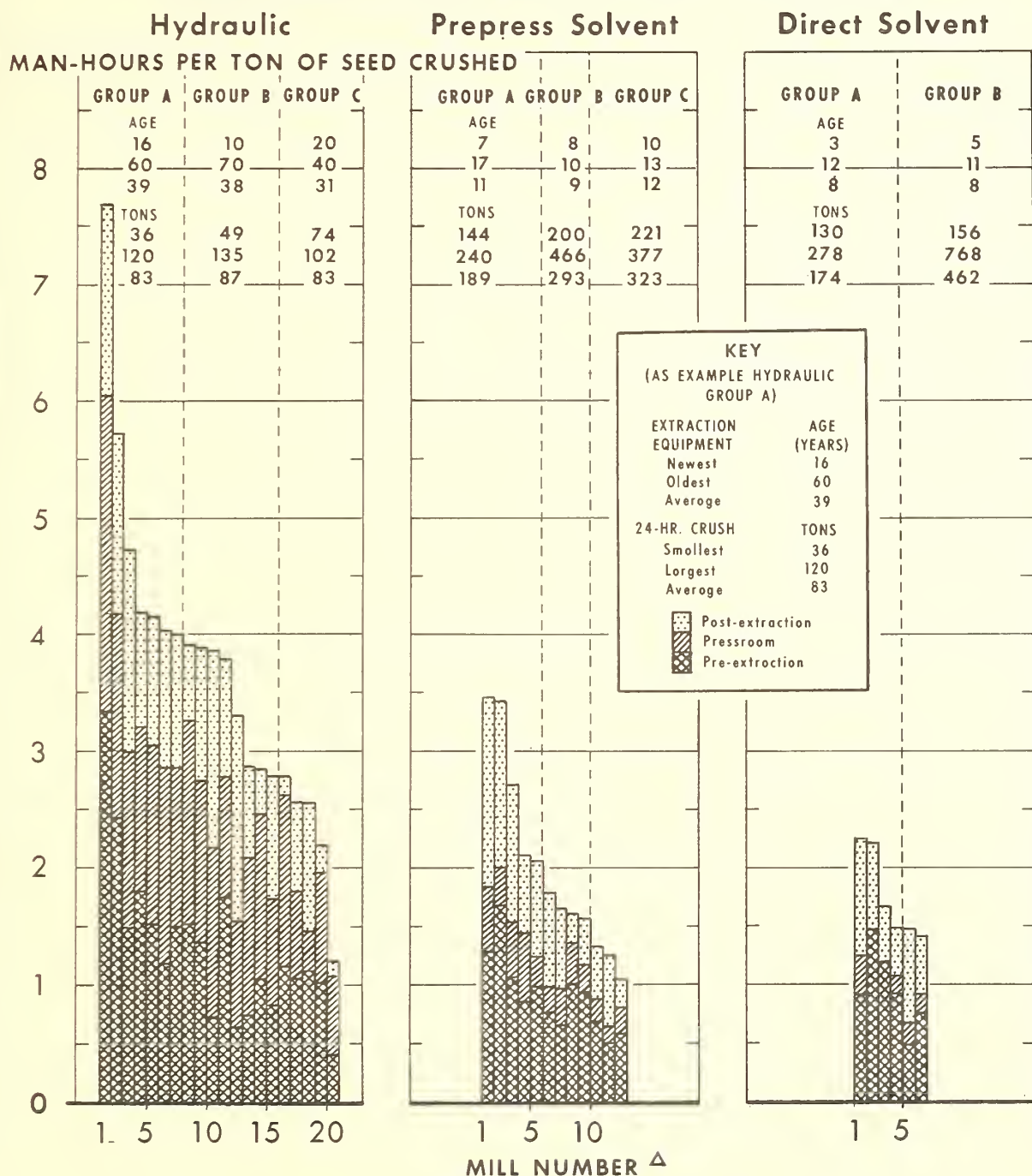
SPECIFIED OPERATING FEATURES, BY SPECIFIED PROCESSES



DATA ARE FOR 1961-62 SEASON.
* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.
SEE FIGURE 9 FOR EQUIPMENT AND CRUSH OF DIFFERENT GROUPS.

Figure 9-A

TOTAL LABOR USED, BY SPECIFIED PROCESSES *



DATA ARE FOR 1961-62 SEASON.

 Δ EXCLUDES UNLOADING LABOR.

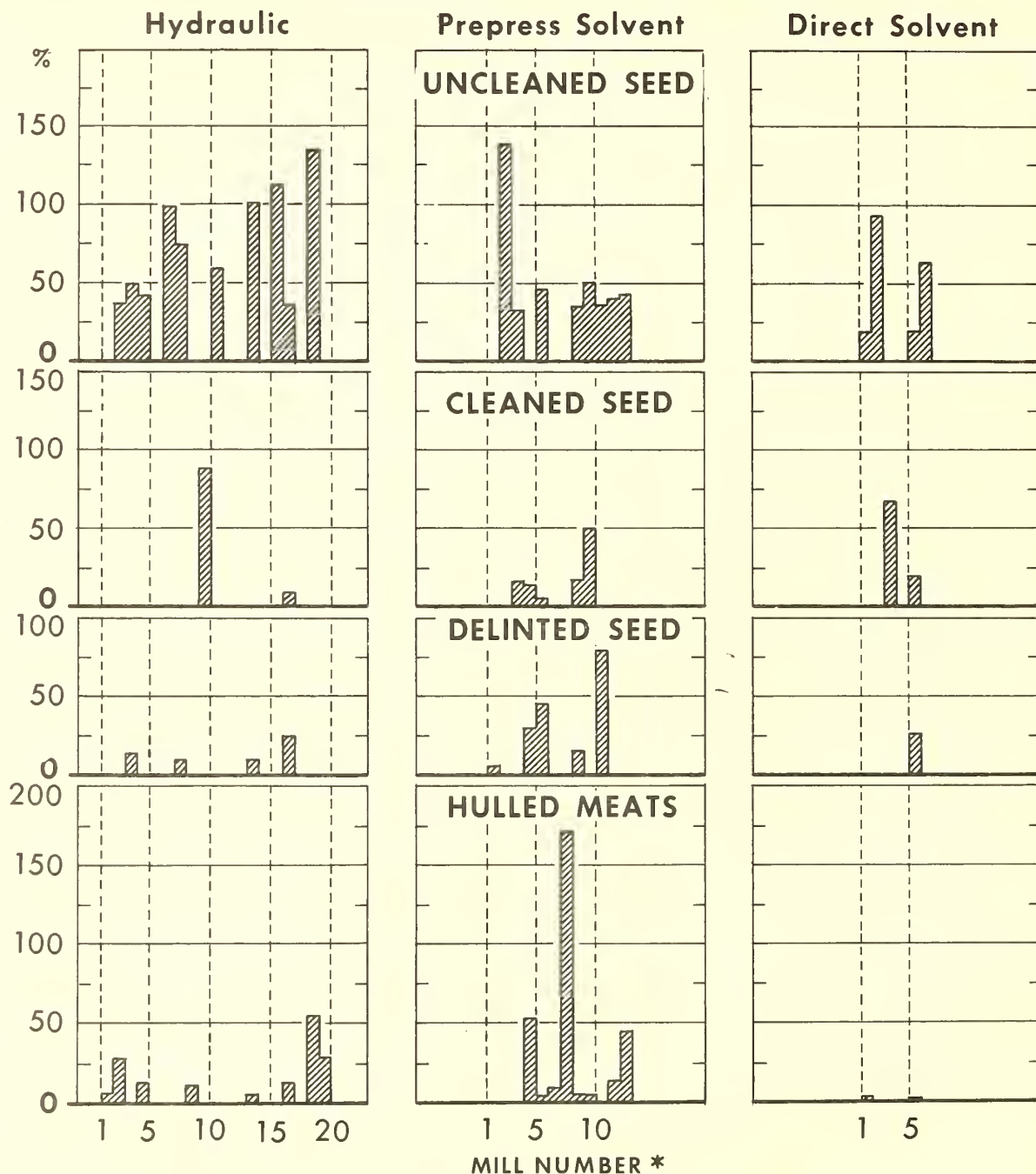
* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

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Figure 9-B

CAPACITY OF HOLDING BINS AS PERCENTAGE OF 24-HOUR CRUSH, BY SPECIFIED PROCESSES



DATA ARE FOR 1961-62 SEASON.
* ARRANGED IN DESCENDING ORDER OF TOTAL MAN-HOURS USED IN PROCESSING.

Figure 10

APPENDIX

The part of the questionnaire concerning use of labor force in a mill

	First shift			Second shift			Third shift		
Cottonseed operation	Num-ber	Aver-age	Length of shift	Num-ber	Aver-age	Length of shift	Num-ber	Aver-age	Length of shift
	of men	hourly wage	(hrs.)	of men	hourly wage	(hrs.)	of men	hourly wage	(hrs.)
Unloading income-									
ing seed.....									
Sterilizing seed:									
Storing seed....									
Removing seed from storage..									
Cleaning seed....									
Lint room.....									
Bale pressroom..									
Huller (separation) room...									
Pressroom (extraction).....									
Meal room.....									
Hull storage and loading...									
Other									

20. Do any members of the labor crew work on more than one of the above operations? No [] Yes []. Explain _____

21. Have you installed any new equipment or made any changes in your plant layout or operating methods in the last 5 years that have reduced your labor requirements for processing cottonseed? No [] Yes []. If yes, explain _____

Name and position of person completing this form _____

Date _____

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